Technology Opportunity

UV-Curable Polyimides

The National Aeronautics and Space Administration seeks to transfer technology for the development and production of polyimides using ultraviolet light, rather than heat, to effect polymerization.

Potential Commercial Uses

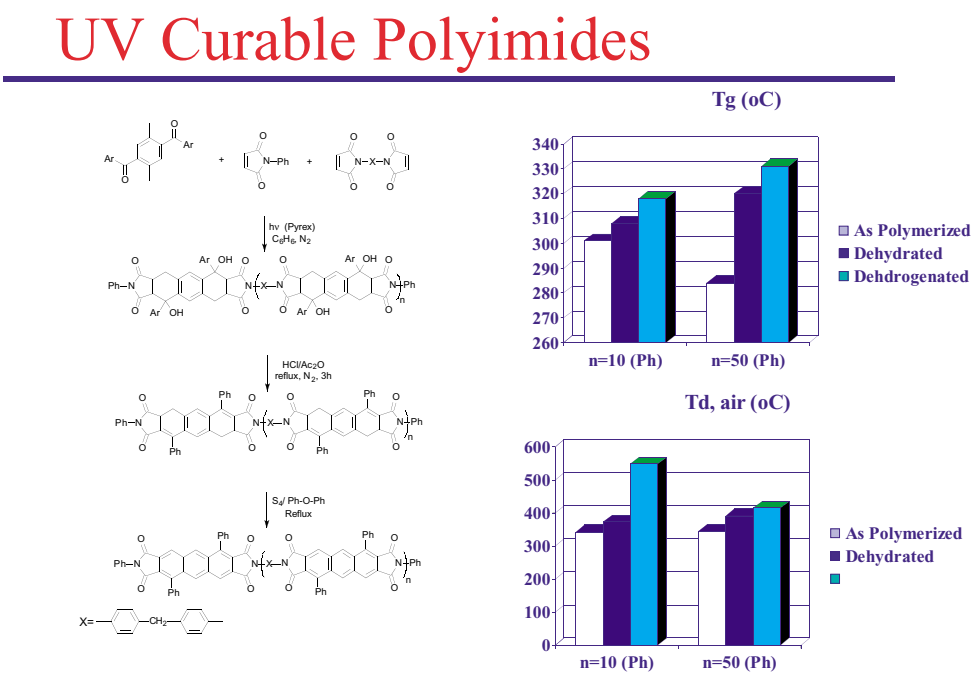
- Aerospace Components
- Automotive Components
- Electronics
- Instrumentation Manufacturing

Benefits

- This ultraviolet-curing approach could offer several advantages over other approaches to the preparation of polyimides.
- Ultraviolet-cured films should undergo less shrinkage during cure than do those films that are cured at high temperatures.
- This approach would be useful for the curing of polyimides that contain such thermally sensitive groups or additives as nonlinear optical materials.
- In addition, this approach does not entail some of the disadvantages of condensation-chemistry-based approaches: namely, the formation of volatiles during cure, health risks associated with the use of diamines, and poor solution stability.

The Technology

Polyimides are often used for high-performance applications in the aerospace and electronics industries. Making these materials traditionally involved the condensation of a diamine with a dianhydride. Aromatic diamines are often toxic, mutagenic, or carcinogenic, resulting in health concerns and costly production control requirements. To overcome these problems, other methods of polymerization using bismaleimides and bisdienes have been developed



that require high reaction temperatures (above 200 °C)—the process is known as Diels-Alder polymerization.

A new Diels-Alder route to the synthesis of polyimides involves the use of ultraviolet light, rather than heat, to effect polymerization. This approach is based upon a well-known class of photochemical reactions—the photoenolization of *o*-methylphenyl ketones—which can be carried out at room temperature. A number of polyimides, with glass transition temperatures as high as 300 °C have been prepared by following this approach. Although this chemistry has only been demonstrated in solution, it is expected to also be able to achieve solid-state (solvent-free) curing. Such adaptation would make the present approach particularly suitable for thin-film applications (e.g., coatings, electronics packaging, and photonic/optical materials.

Options for Commercialization

This technology opportunity is part of the NASA Technology Transfer Program. NASA researchers are interested in continuing to develop this approach with those in industry and academia and are seeking industrial partners to cooperatively develop additional applications for this new process.

Contact

Commercial Technology Office
Attn: TOPS
NASA John H. Glenn Research Center
at Lewis Field
Mail Stop 7–3
Cleveland, OH 44135–3191
Phone: (216) 433–3484
Fax: (216) 433–5012
E-mail: cto@grc.nasa.gov
http://cto.grc.nasa.gov

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